

## Online Real-Time Tribology Failure Detection System, Phase II

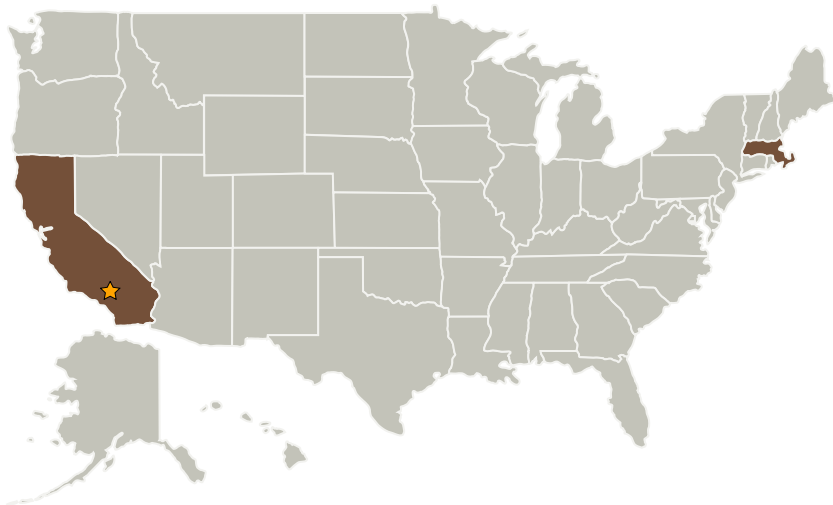
Completed Technology Project (2007 - 2009)



## Project Introduction

Under NASA Phase I funding, we have developed a system for the ball bearing fault detection and identification. Our system can effectively identify multiple fault modes related to the evolution of friction within the contact in the coated ball bearings. To detect bearing faulty modes, we have developed a new bispectrum and entropy analysis method to capture the faulty transient signals embedded in the measurements. To classify the fault modes, we further developed a set of stochastic models using hidden Markov model (HMM) and Gaussian mixtures. Test results using lab experiment data have shown that our system can identify coated ball bearing fault modes in near real-time. In Phase II, we will further develop and test our system developed in Phase I for spacecraft mechanical parts health monitoring and mitigating actions. A thorough understanding of the failure mechanisms of the moving parts will emerge by the end of the Phase II effort, as well as the methodology to prevent catastrophic failure while in orbit. Algorithms developed in Phase I/II will be implemented in C/C++. Effort will be focused on the accuracy, autonomous, speed and efficiency of the system. The Boeing Company has teamed with us for Phase II effort.

## Primary U.S. Work Locations and Key Partners



Online Real-Time Tribology  
Failure Detection System, Phase  
II

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Organizational  
Responsibility**Responsible Mission  
Directorate:**

Space Technology Mission  
Directorate (STMD)

**Lead Center / Facility:**

Armstrong Flight Research  
Center (AFRC)

**Responsible Program:**

Small Business Innovation  
Research/Small Business Tech  
Transfer

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Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California
Migma Systems, Inc.	Supporting Organization	Industry	Walpole, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

## Project Transitions

**November 2007:** Project Start**November 2009:** Closed out

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX11 Software, Modeling, Simulation, and Information Processing
  - └ TX11.1 Software Development, Engineering, and Integrity
  - └ TX11.1.4 Operational Assurance